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ABSTRACT

This curriculum guide lists mathematics topics and concepts, learning outcomes, and sample learning objectives (in three columns) for these secondary school mathematics courses in Alaska: (1) general mathematics; (2) consumer mathematics; (3) pre-algebra; (4) algebra I; (5) algebra II; (6) geometry; (7) trigonometry; (8) precalculus; and (9) calculus. Topics/concepts, in the first column, describe the major parts of the subject under consideration. They define broadly the content to be included in the study of each subject area. Learning outcomes, in the second column, describe, in general terms, the behaviors students are expected to demonstrate as a result of their learning experiences. These outcomes are the goals toward which student learning is directed. Sample learning objectives, shown in the third column, are indicators of student progress toward the stated goals. At least one sample learning objective is stated for each learning outcome. The concepts and topic areas for the nine courses (which are included in the topics/concepts column) are listed in an appendix. (JN)

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Mathematics

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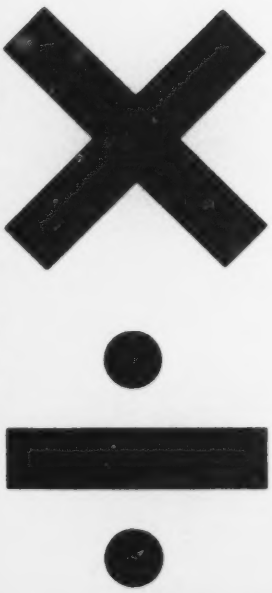
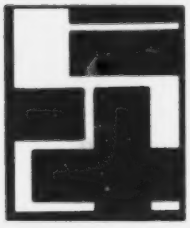


SECONDARY MATHEMATICS

ALASKA CURRICULUM GUIDE

First Edition



Support of the Model Curriculum Project was provided through a special grant from ECIA Chapter II (Block Grant)

Alaska Department of Education

August 1985

SECONDARY MATHEMATICS

TABLE OF CONTENTS

Preface to the Series.....i
Preface.....iv
Acknowledgements.....vi
General Math.....1
Consumer Math.....10
Pre-Algebra.....19
Algebra I.....26
Algebra II.....36
Geometry.....48
Trigonometry.....58
Precalculus.....64
Calculus.....71
Appendix A.....1

"There cannot be a precise answer to a vague question."

Samuel Johnson

PREFACE TO THE SERIES

Among the many decisions that schools must make, none is more important than the choice of curriculum. Curriculum defines the intent behind instruction and the expectations for student performance. This first field edition curriculum guide is one of a series intended to serve as a model to aid school districts as they develop and review their own curriculum documents. It is not intended that any of these field edition guides be used directly by teachers for instructional purposes. Districts are expected to develop their own locally suitable curriculum based on these guides. Districts have or are developing their own locally suitable curriculum using these guides as a base and point of departure. In the future as schools use this material to plan and implement programs, its value will be measured by the increased abilities of students to learn, think, and perform as informed and productive citizens.

In their present form these guides represent a synthesis of input from many sources, both Alaskan and national. They were originally prepared by staff at the Department of Education with the help of professional content associations, Alaskan teachers and administrators. An extensive review and revision process was conducted in 1984-85. School districts, subject matter associations, other professional associations, and interested individuals provided input to a revision process that was contracted to the Northwest Regional Educational Laboratory. A panel of nationally recognized curriculum specialists assisted in the review of each content area. contributors to specific guides are listed in the acknowledgements sections of those guides. In

one sense, these guides will never be finished. It is the intention of the Department of Education that they be dynamic documents subject to revision every few years as part of the six year curriculum review cycle that was recently initiated by new curriculum regulations. Guides exist in the areas of:

Kindergarten	Fine Arts
Language Arts	Social Studies
Science	Computer Education
Foreign Languages (Secondary)	Health
Mathematics	Physical Education

The format of the guides is straightforward but not oversimplified. Each guide lists topics/concepts, learning outcomes, and sample learning objectives in three columns. (In the case of Secondary Foreign Language, the first column is headed topics/skills.)

Topics/concepts, in the first column, describe the major parts of the subject under consideration. They define broadly the content to be included in the study of each subject area.

Learning outcomes, in the second column, describe, in general terms, the behaviors students are expected to demonstrate as a result of their learning experiences. Learning outcomes are the goals toward which student learning is directed.

Sample learning objectives, shown in the third column, are indicators of student progress toward the stated goals, i.e., the learning outcomes. At least one sample learning objective is stated for each learning outcome. It is intended that the sample learning objectives are just that: samples only. They do not constitute a learning program. School districts generate their own locally applicable learning objectives within the framework of their district topics/concepts and learning outcomes.

The guides are grouped by grade level groupings (except Mathematics) -- grades 1-3, 4-6, 7-8 for the elementary level, and 9-12 for the secondary level. Mathematics is presented sequentially grade by grade. Recognizing the unique characteristics of the five year old learner, Kindergarten was prepared as a separate guide. In the development, grades 7-8 were generally seen as the end of the elementary years, but with some beginnings for the secondary level. On the secondary level the guides generally contain discrete courses that would be offered; these are not always tied to a particular grade level as the local district must determine the most effective sequence for those courses.

The Alaska State Board of Education stated, "The Model Curriculum Guides are intended to serve as a model, not a mandate." They underscored the fact that a partnership between state and local school districts is crucial. We seek to promote individual variation while stressing the collective responsibility for educating all students in Alaska. It is in this spirit that the Department of Education welcomes the opportunity for continuous collaboration with those interested in the further development and refinement of this entire series of guides.

PREFACE TO

SECONDARY MATHEMATICS CURRICULUM GUIDE

The major goal of the Alaska Mathematics Curriculum Guide for secondary students is to provide a set of related and specific goals, instructional objectives and choice of essential subject matter. This is done through an exemplary model that incorporates the clearest and most viable ideas about mathematics and the teaching of mathematics.

Therefore, specific goals of the Alaska Secondary Mathematics Curriculum Guide have been developed to help young people do the following:

1. Use the language and symbolism of sets, set operations and their properties.
2. Use the principles of inductive and deductive logic.
3. Measure things using specific units of measure.
4. Use the symbols, elements, operations and functions of whole numbers, integers, rational numbers, real numbers and when appropriate, complex numbers and finite and infinite systems.
5. Solve open sentences.
6. Solve problems using graphs, tables and mathematical statements.
7. Use problem identification, analysis, organization, evaluation, application and generalization to solve real and everyday problems.
8. Value the development of mathematical skills and knowledge.
9. Solve practical problems using mathematical sentences or models and interpret the solution in the context of the problem.

10. Use geometric definitions, postulates and theorems to solve problems.

11. Compute using numbers and algebraic expressions.

12. Describe the importance of counting, measuring, mathematical symbols and systems to historical and cultural development.

13. Use probability and statistics to solve problems.

14. Use calculators, computers, slide rules and other support technology to solve problems.

For each topical area, learning outcomes are written as broad-based educational goals which lie on a continuum of specificity. The outcomes represent a sequential flow of content matter and are based on students' developmental patterns. Sample learning objectives are given for the outcome statements, written in behavioral terms and which also reflect a continuum of specificity.

The intent of the sample learning objectives is to suggest possible ways students might be able to demonstrate their mastery of the learning outcomes. Other objectives should also be developed for the same purpose to more accurately reflect student experiences and abilities, available resources or student needs and interests.

ACKNOWLEDGEMENTS

In preparing the Model Curriculum Guides, the Department of Education requested and received copies of curriculum materials from school districts in Alaska, the state's own Centralized Correspondence Study and other state departments of education. The department thanks the following school districts and state departments for submitting materials:

Alaska School Districts

Adak
Anchorage
Annette Island
Bristol Bay
Copper River
Cordova
Craig
Delta/Greely
Fairbanks
Galena
Haines
Iditarod
Kenai Peninsula
Ketchikan
Klawock
Lower Kuskokwim
Lower Yukon
Matanuska-Susitna
Nenana
Nome
North Slope
Northwest Arctic
Pelican
Railbelt
Valdez
Yakutat

State Departments of Education

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Arkansas
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Delaware
Florida
Idaho
Ilinois
Indiana
Maine
Minnesota
Maryland
Nebraska
Nevada
new Mexico
New York
North Carolina
Oregon
Rhode Island
South Carolina
South Dakota
Tennessee
Texas
Utah
Vermont
Virginia
West Virginia
Virgin Islands
Guam

The department appreciates the efforts of its staff who reviewed and synthesized specific content area materials which resulted in this draft Model Curriculum Guide. Contributors in secondary mathematics included:

Freda Braley
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Roy Henderson
Margaret MacKinnon
Richard Spaziani

The department also appreciates the efforts of members of the Alaska Council of Teachers of Mathematics who reviewed and critiqued an earlier draft of this Model Curriculum. Working within very tight timelines, they provided useful and helpful suggestions for how the document could be improved. People who were involved included:

Doris Ayres, Eagle River
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Alicia Newman, Anchorage
Dennis Ostrander, Soldotna
Louise Petermann, Anchorage
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James Simeroth, Kenai
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Caroline Valentine, Anchorage
Virginia Walters, Kenai
Dorothy Zarelli, Eagle River

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Holly Stephans, A.C.T.M.
Louise Petermann, A.C.T.M.
Marla Trible, C.C.S.

The Northwest Laboratory's chief writer for this Secondary Mathematics Guide was Leslie Crohn. Dr. Shirley A. Hill, University of Missouri, Kansas City, was chief consultant to this NWREL team. Dr. Dana Davidson was consultant on matters of child development. Project design and management was by Dr. William G. Savard of NWREL's Assessment and Evaluation Program. Dr. Gary Estes provided overall direction.

Special thanks are due to Gloria Lerma and Andrea Levy for their cheerful and seemingly endless typing and management of details.

SECONDARY MATH GUIDES
GENERAL MATH

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
WHOLE NUMBERS	Know how to read, round and estimate with whole numbers.	
		Name all place values from ones to millions.
		Round off whole numbers to a given place value.
		Estimate sums, differences, products and quotients of whole numbers.
		Order a set of whole numbers from least to greatest.
	Know how to add, subtract, multiply and divide whole numbers.	
		Use addition, subtraction, multiplication and division algorithms to compute sums, remainders, products and quotients.
		Perform basic computations involving whole numbers.
NUMBER THEORY	Understand number theory concepts.	
		Identify prime and composite numbers.
		Identify the prime factorization of composite numbers and explain its uniqueness.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
NUMBER THEORY (Cont.)		Find multiples of a number; identify the least common multiplier (LCM) of a set of whole numbers. Use exponential notation; perform operations with exponents.
FRACTIONS	Understand fraction concepts as they apply to the solution of problems.	
		Identify equivalent fractions and mixed numbers. Compare and order fractions and mixed numbers. Add and subtract fractions and mixed numbers. Multiply and divide fractions and mixed numbers.
	Know how to read, write, simplify and order fractions.	
		Represent any fraction in each of the following three models: area/volume, number line and set. Use any of the fraction models to demonstrate the equivalence of a set of fractions.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
FRACTIONS (Cont.)		Give reciprocals of fractions and whole numbers.
		Find the lowest common denominator of a fraction.
DECIMAL FRACTIONS	Know how to read, write, round and order decimals.	
		Use reciprocals to find quotients of two fractions.
		Read and write decimals to one-hundred thousandths.
		Give place values for any digit in a decimal fraction.
		Round off decimals to any specified place value.
	Know how to add, subtract, multiply and divide decimals, fractions and mixed numbers.	
		Perform basic computations involving decimal fractions.
		Add or subtract fractions or mixed numbers with a common denominator, and with different denominators.

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
RATIO, PROPORTION AND PERCENT	Understand ratio, proportion, and percent.	
		Write ratios from sentences and/or problems.
		Use cross products to determine if ratios are equal.
		Find a missing term in proportions.
		Solve word problems involving ratios and proportions.
		Solve percent, ratio and proportion problems.
		Rename ratios as decimals and percents and conversely.
		Explain the similarities and differences between "fractions" and "ratios".
MEASUREMENT	Understand the English and metric systems of measurement.	
		List metric prefixes and their numerical equivalents.
		Estimate the distance between two given points using English or metric units of measurement.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
MEASUREMENT (Cont.)		Measure the length of any segment using the appropriate English or metric unit of length.
	Know how to find perimeter, circumference and area.	
		Find the perimeter of a polygon given its dimensions.
		Find the circumference of a circle in terms of pi, using the standard formula.
		Find the areas of rectangles, triangles and quadrilaterals given appropriate dimensions.
		Calculate the area of a circle using the standard formula and either the radius or diameter.
	Know how to find volume and capacity.	
		Calculate the volume of a rectangular prism, pyramid, cylinder or cone, using standard formulas.
		Estimate the capacity of various containers within reasonable limits.

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
MEASUREMENT (Cont.)	Know how to find weight (mass).	
		Estimate the weight (mass) of an object within reasonable limits.
	Know how to solve problems related to time.	
		Calculate the number of days from one date to another.
		Restate the time in hours for number of minutes greater than sixty.
		Calculate the number of hours for a specific number of days.
	Know how to solve problems related to temperature.	
		Use terms associated with temperature measurement in both Fahrenheit and Celsius scales.
		Measure and compare temperatures using both scales.
INTEGERS	Understand concepts related to integers.	
		List the next largest or smallest integer for any given integer.
		Represent the relation of two integers by using a symbol of inequality.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
INTEGERS (Cont.)		Describe the concept of absolute value.
		Add, subtract and multiply integers.
		Use a number line to represent and order integers.
GRAPHING	Know how to graph in the rectangular coordinate system.	
		Locate and plot points in all quadrants.
		Compute distances between points in the coordinate plane.
PROBABILITY	Understand basic concepts of probability.	
		Conduct simple probability experiments.
		Determine mathematical probabilities of simple events.
STATISTICS	Know how to tabulate data and interpret graphs and tables.	
		Use information from graphs and charts to solve problems.
		Construct bar, circle, line or picture graphs to represent numerical data.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
STATISTICS (Cont.)		Construct frequency tables from numerical data. Interpret graphs and charts and determine frequencies.
WORD PROBLEMS	Know how to solve word problems.	Solve an everyday or personal problem using data from charts or graphs. Solve one-step word problems, and problems involving more than one step or operation. Identify different ways to organize and solve problems. Use appropriate formulas to solve problems. Estimate answers to word problems. Analyze a solution to determine its fit with a given problem.

SECONDARY MATH GUIDES
GENERAL MATH

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
CAREER EDUCATION	Understand how skills in math relate to employability.	
		Identify part-time and full-time jobs that require knowledge of math such as metrics, reasoning and geometrical concepts.
		Calculate and display with a line or bar graph, the annual earnings progression of jobs within a company from the lowest paying to the highest paying; calculate the means, medians, and modes of the annual earnings.
		Identify in five, math-related occupations the need and level of responsiveness in the following areas: punctuality, mathematical accuracy, personality, helpfulness.
CALCULATORS AND COMPUTERS	Know how to use common calculating devices. (See also Secondary Computer Education Curriculum Guide.)	
		Use math tables and a calculator to solve problems.
	Know how to use a computer to solve problems.	
		Use the vocabulary, definitions and operational procedures associated with computers and their peripherals as appropriate to needs and interests.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
BASIC MATH SKILLS	Know how to compute whole numbers, fractions and decimals as an aid to solving consumer math problems.	
		Add, subtract, multiply and divide whole numbers, fractions, decimals, ratios and percents as they occur in consumer math problems.
ESTIMATION	Know how to estimate to solve consumer math problems.	
		Estimate results after being given necessary data to solve consumer math problems.
		Estimate answers by rounding the figures involved and calculating with the rounded numbers.
GRAPHS	Know how to use line, bar and circle graphs as aids to solving consumer math problems.	
		Draw, read and apply line, bar, and circle graphs to the solution of consumer math problems.
		Draw a circle graph showing given percentages and ratios applicable to solving a consumer math problem.
		Read and interpret graphs from a newspaper.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
DECISION MAKING SKILLS	Understand the considerations involved in making a large purchase.	
		Compare costs of purchasing a used car (or appliance) with the costs of purchasing a new car (or appliance).
		Apply the need and cost variables to determine the best choice between two or more options involving the purchase of a car or large appliance.
		Calculate the monthly car payments given the total cost and terms of credit.
		Calculate sales tax given the list price and the percent of tax.
		List and calculate the operating costs of a car or large appliance.
		Calculate miles per gallon and cost per mile.
	Know how to determine living costs.	
		Calculate living costs including food, transportation, shelter, insurance, etc.
		Calculate the costs of purchasing a home including down payment and amount to be financed, given the list price of a home and percent of down payment.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
DECISION MAKING SKILLS (Cont.)		Calculate the costs involved in maintaining a home. List alternative housing choices and calculate the monthly costs of each. Calculate the cost of utilities.
	Know how to determine future education costs.	
		Determine the cost of attending a college or training program in preparation for each of two possible careers; select different alternatives to meet the financial needs associated with further education or training.
COMPARISON SHOPPING	Know how to order from a catalog.	
		Complete an order form, including shipping charges and taxes from a mail order catalog. Evaluate store buying vs. catalog buying. Calculate a sale price when a discount is offered.

SECONDARY MATH GUIDES
CONSUMER MATH

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
COMPARISON SHOPPING (Cont.)	Know how to get the best buy in a supermarket, or local store.	
		Calculate unit price.
		Calculate the better buy, given two different sizes of packaged products of equal quality.
		Calculate the cost per item, given the price of a multiple purchase.
INSURANCE	Understand different types of insurance and their purposes.	
		List and define the various types of life and car insurance.
		List and define the various types of insurance coverages pertaining to home owner and renter protection.
		Calculate the insurance premium for different types of car insurance, given necessary variables such as age, sex, marital status, use of car and geographic location.

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
TAXES	Understand federal income tax forms and related vocabulary.	
		Define the terminology used in preparing federal income tax forms.
		Select the appropriate form given specific information.
		Complete short and long tax forms, given necessary information.
		Calculate personal income tax.
EMPLOYMENT	Know how to determine prospective job opportunities.	
		Identify possible job opportunities from the classified ads.
		List alternatives for identifying job opportunities and analyze the advantages and disadvantages of each.
		Complete an employment form.
	Know how to calculate earnings.	
		Define the following: piece work, commission, hourly, weekly and monthly wages.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
EMPLOYMENT (Cont.)		Calculate earnings based on hourly, weekly or monthly wages.
		Interpret a payroll stub.
	Know how to solve math problems related to careers.	
		Solve math problems related to business, technical or construction careers.
BANKING	Understand the various types of checking and savings accounts, and how to use them.	
		List and describe various types of checking accounts.
		Fill out a deposit slip, check and check stub.
		Reconcile a checking account, given a bank statement and cancelled checks.
		Calculate the interest on savings accounts, given the principal and rate of interest.
CREDIT	Understand various types of credit; know how to use credit wisely.	
		Identify the types of credit available to consumers.
		Calculate the interest associated with credit buying.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
BUDGETING	Know how to develop a workable budget.	Determine the amount allocated to each category of a family budget, given net income and a circle graph showing percentages of expenditures. Develop a workable budget given net income and identified expenses.
INVESTING	Know various ways to invest money.	State the difference between stocks, bonds and certificates of deposit. Report on investment possibilities of the following: stocks, bonds, certificates of deposit, real estate, treasury bills, precious metals.
WORD PROBLEMS	Know how to solve word problems related to consumer situations.	Use pictorial or graphic representations as aids in solving consumer-related problems. Solve consumer-related problems in which part of the information is contained in pictures or charts. Solve word problems involving more than one step or operation.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
WORD PROBLEMS (Cont.)		
		Identify different ways to organize and solve consumer-related problems.
		Determine if a solution fits a given consumer-related problem.
PROBABILITY AND STATISTICS	Understand how knowledge of probability and statistics affects the consumer.	
		Report on various games of chance to determine if gambling pays.
		Demonstrate sampling and predict from samples.
CALCULATORS AND COMPUTERS	Know how to use a calculator as an aid to solving consumer math problems. (See also Secondary Computer Education Curriculum Guide.)	
		Add, subtract, multiply and divide with a calculator to solve consumer related problems.
		Figure percentages, averages, square roots on a calculator to help solve consumer related problems.
		Demonstrate the use of the memory and all standard functions of a calculator.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
CALCULATORS AND COMPUTERS (Cont.)		Calculate the costs of alternative forms of transportation.
	Know how to use a computer to solve problems.	
		Use the vocabulary, definitions and operational procedures associated with computers and their peripherals as appropriate to needs and interests.

SECONDARY MATH GUIDES
PRE-ALGEBRA

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
NUMBER THEORY	Know how to factor whole numbers.	Identify numbers which are prime and those which are composite. List all possible factors of a set of composite numbers. Find the prime factorization of a composite number. Apply the rules of divisibility to determine whether or not a number is divisable by two, three, four, five, six, nine or ten. Find the LCM for a set of numbers. Find the GCF for a set of numbers.
FUNDAMENTAL OPERATIONS	Know how to perform operations with fractions and decimal fractions.	Add, subtract, multiply and divide fractions and decimal fractions. Write equivalent expressions for the conversion of fractions to decimals; decimals to fractions; fractions to percents; percents to fractions; decimals to percents; percents to decimals.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
FUNDAMENTAL OPERATIONS (Cont.)		Round whole numbers or decimals to any place value.
		Estimate the sum, difference, product or quotient of whole numbers or decimals.
RATIO, PROPORTION, AND PERCENT	Understand ratio and proportion.	
		List examples of equivalent ratios.
		Solve problems involving proportion.
	Know how to solve problems involving percent.	
		Calculate a given percent of any number.
		Find what percent one number is of another.
		Solve word problems involving discount or simple interest.
EXPONENTS	Understand exponents.	
		Rewrite the value using an exponent for a group of like factors.
		Rewrite a number in exponential form in expanded notation.
		Calculate the value of the number, given a number a^n where a and n are natural numbers.

SECONDARY MATH GUIDES
PRE-ALGEBRA

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
PROPERTIES	Understand properties of numbers.	Demonstrate how to use the following: commutative properties of addition and multiplication; associative properties of addition and multiplication; additive identity; multiplication property of zero; multiplication identity; distributive property.
SQUARE ROOT	Understand square root.	State the principal square root for a natural number less than 150 which is a perfect square. Determine the approximate square root of any natural number using appropriate tables.
SCIENTIFIC NOTATION	Know how to use scientific notation.	Write in decimal notation the value of a number given in scientific notation.
INTEGERS	Understand the concept of integers.	State the opposite of an integer other than zero. Order integers, using correct symbols. Add, subtract, multiply and divide integers. Define and determine absolute values of integers.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
ALGEBRAIC EQUATIONS AND INEQUALITIES	Understand algebraic form and simple linear inequalities.	
		Translate statements from written form to algebraic form and conversely.
		Solve algebraic equations.
		Solve simple linear inequalities.
	Understand that a number sentence may represent an analysis of a problem situation.	
		Replace variables with numbers to make open sentences true.
		Identify math sentences as true, false or open.
MEASUREMENT	Know how to find perimeter, area and volume.	
		Find the perimeters of polygons and the circumferences of circles.
		Find the areas of polygons and circles.
		Find the surface areas of prisms, cylinders and pyramids.
		Find the volumes of prisms, cylinders, pyramids, spheres and cubes.

SECONDARY MATH GUIDES
PRE-ALGEBRA

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
GRAPHING	Know how to graph on number lines and coordinate planes.	
		Label the points of a graph as points on the plane.
		Graph linear equations in two variables on the coordinate plane.
	Know how to interpret information presented on a graph.	
		Determine the maximum and minimum values represented on a graph.
		Explain the scale used on a graph.
		List the area or region representing the greatest or least change for any graph.
	Know how to collect, organize and display data on a graph.	
		Collect numerical data for a selected topic and tally the distribution.
		Represent collected data on a bar, line or circle graph.
		Analyze the data and find the range, mean, mode and median.
		Explain the results of the data.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
OPERATIONS WITH MATHEMATICAL EXPRESSIONS	Know how to perform operations that involve mathematical expressions.	
		Simplify mathematical expressions.
		Evaluate expressions given the numerical values for variables.
		Add and subtract polynomials.
WORD PROBLEMS	Know how to solve word problems.	
		Use pictorial or graphic representations as aids in solving problems.
		Distinguish relevant information when solving word problems.
		Solve problems involving more than one step or operation.
		Identify different ways to organize and solve problems.
		Estimate answers to word problems.
		Analyze a solution to determine its fit with a given problem.

SECONDARY MATH GUIDES
PRE-ALGEBRA

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
CALCULATORS AND COMPUTERS	Know how to use calculating devices to solve problems. (See also Secondary Computer Education Curriculum Guide.)	
		Use tables and calculators as tools in solving problems.
	Know how to use a computer to solve problems.	
		Use the vocabulary, definitions and operational procedures associated with computers and their peripherals as appropriate to needs and interests.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
AXIOMS FOR REAL NUMBERS	Know the meaning of symbols used in algebra.	
		Identify the meaning of the following symbols used for mathematical operations: -, +, x, ÷
		Recognize the symbols which are used for grouping in algebra (e.g., parentheses, brackets, braces).
		Identify symbols used for ordering and in set notation.
SETS, NUMBERS, OPERATIONS	Know how to perform basic set operations.	
		Define the meanings of the following terms used to describe sets: null, subset, finite, and disjoint.
		Define sets by listing and by description.
		Define the following set operations: union, intersection.
	Understand basic set operations.	
		Show set operations using Euler circles, mappings and/or Venn diagrams.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
SETS, NUMBERS, OPERATIONS (Cont.)	Know properties which are true for an operation or operations on given subsets of the real numbers.	
		Define the Property of Closure.
		Define the commutative property.
		Define the associative property.
		Demonstrate how to use the identity element.
		Explain how to use the identity element in sets containing inverse elements.
		Explain why subtraction and division are neither associative nor commutative.
	Know the relationship between operation and its inverse.	
		Express the difference of two integers a and b as the sum of a and the "opposite" (additive inverse) of b; $a - b = a + (-b)$.
		Explain that raising a number to the nth power, where n is a positive integer, and finding the nth root are inverse operations.
	Know the properties of equalities.	

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
SETS, NUMBERS, OPERATIONS (Cont.)		Give examples of the following properties: reflexive, transitive, symmetric, additive, multiplicative.
		Demonstrate the Trichotomy Law.
	Know the properties of inequalities.	
		Restate the following properties of inequalities and present examples of each: transitive, addition, multiplication.
		Demonstrate that for real numbers a and b, $a > b$ if and only if $a - b > 0$.
		Demonstrate that the product of two real numbers is zero if and only if one or both of the factors are zero.
		Describe division by zero as undefined.
RELATIONSHIPS OF NUMBER SETS	Understand the relationship between the different number systems.	
		Define natural, whole, rational, irrational, real, imaginary and complex numbers.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
RELATIONSHIPS OF NUMBER SETS (Cont.)	Know the forms that indicate the types of variations needed to solve problems.	
		Recognize which type of variation is needed to solve the problem (e.g., direct, indirect, inverse, joint or combined).
		Use direct variation to solve a problem.
LINEAR EQUATIONS AND INEQUALITIES		
	Know the characteristics of linear equations and inequalities.	
		Determine the equivalent of an inequality of the form $ax + b > c$.
	Know how to graph the solutions of inequalities involving absolute values.	
		Define absolute values.
		Graph equations involving absolute value.
		Graph inequalities.
		Solve equations involving absolute value.
	Know how to classify and graph functions.	
		Classify examples of functions (e.g., constant, linear, quadratic, exponential, trigonometric).

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
LINEAR EQUATIONS AND INEQUALITIES (Cont.)		Sketch the linear graph for a function, f with numbers m and b such that $f(x) = mx+b$.
		Describe a polynomial function as a function defined by a polynomial in one variable of any degree.
		Explain that a rational function is a quotient of two polynomial functions.
	Know how to graph exponential functions.	
		Solve and graph exponential functions.
	Understand logarithms.	
		Define a logarithmic function as the inverse of an exponential function.
		Graph the inverse of a relation.
		Graphically represent a polynomial function.
		Graph rational functions.
		Evaluate and graph exponential functions.
		Graph logarithmic functions.
		Perform fundamental arithmetic operations on functions and determine the domain and range of the new function.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
LINEAR EQUATIONS AND INEQUALITIES (Cont.)		Solve a word problem whose solution depends on the knowledge of relations and functions. Use knowledge of relations and functions to design and solve real life problems.
LINEAR SYSTEMS	Know how to solve systems of two equations in two variables.	Define a linear system. Solve a system of two equations in two unknowns by graphing. Solve a system of two equations in two unknowns using elimination or substitution. Solve a system of two equations in two unknowns using determinants (Cramer's Rule).
	Know how to solve systems of three linear equations in three variables.	Solve a system of three equations having three variables using elimination or substitution method.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
LINEAR SYSTEMS (Cont.)		Solve a system of three linear equations having three variables using determinants (Cramer's Rule).
		Explain the rationale used by a computer program to solve large systems of equations and inequalities.
	Know how to solve problems whose solutions depend on a knowledge of open sentences.	
		Translate a word problem into an open sentence and the converse.
	Know the various types of solution sets possible for a system of n linear equations in n variables.	
		Explain that a system of n linear equations in n variables may have the following: (1) an empty solution set (inconsistent); (2) a single member in its solution set (consistent and independent); (3) infinitely many members in its solution set (consistent and dependent).
	Know how to recognize a graph of equations in an inconsistent system of two linear equations in two variables or three in three variables.	

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
LINEAR SYSTEMS (Cont.)		Predict that graphs of an inconsistent system of two linear equations in two variables or in three variables may consist of the following: (1) two parallel lines, three parallel lines, (2) two coincident planes parallel to a third plane; (3) three planes intersecting in three parallel lines; (4) two parallel planes intersecting a third plane. Sketch a sample of each of the graphs in the preceding.
	Know how to graph a system of linear equations.	
		Explain that points in a Cartesian 3-space map one-to-one onto and/or into the set of ordered triples of real numbers. Sketch the graphs of space figures, including their traces in the three mutually perpendicular planes. Define linear programming as the solution of systems of linear inequalities with linear constraints for maximum or minimum outcomes.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
POLYNOMIALS AND FACTORING	Know terms associated with polynomials.	
		Define the following terms: monomial, binomial, trinomial, polynomial, degree, term, literal, coefficient, variable, constant, factor, common.
		Classify a polynomial by the number of terms, by degree or by the nature of the coefficients.
	Know how to use polynomials in computation.	
		Perform the four basic operations on polynomials.
		Simplify polynomial expressions (collect common terms).
		Order a polynomial in the standard form (e.g., ascending order of terms).
	Know how to factor polynomial expressions.	
		Apply the distributive law to factoring and multiplying polynomials.
		Define "factoring a polynomial over a set."
		Factor non-prime second degree polynomials of the form $ax^2 + bx + c$ and $ax^2 + bxy + cy^2$ over a given set.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
POLYNOMIALS AND FACTORING (Cont.)		Factor polynomials by inspection (e.g., perfect square trinomials, difference of two squares, the sum or difference of two cubes). Apply the Factor Theorem to find and verify factors of a polynomial. Apply the Remainder Theorem and synthetic substitution to evaluate a polynomial for any real number. Apply the Rational Root Theorem to polynomial equations to find rational roots.
CALCULATORS AND COMPUTERS	Know how to use a computer to solve problems. (See also Secondary Computer Education Curriculum Guide.)	Use the vocabulary, definitions and operational procedures associated with computers and their peripherals as appropriate to needs and interests.
	Know how to use calculating devices to solve problems.	Use tables and calculators as tools in solving problems.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
RATIONAL ALGEBRAIC EXPRESSIONS		
	Understand rational and algebraic expressions.	
		Express an integer in fraction form.
		Define a rational expression as the quotient of two polynomials (P1 divided by P2 where P2 is not zero).
		Add, subract, multiply and divide rational expressions.
		Recognize simplest form of a rational expression.
		Simplify rational algebraic expressions, including those with nonintegral exponents.
		Identify the reciprocal multiplication inverse of any rational number except zero.
		Describe the decimal representation of rational numbers as terminating or infinitely repeating.
		Describe the decimal representation of irrational numbers as infinitely non-repeating.

SECONDARY MATH GUIDES
ALGEBRA II

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
RELATIONS AND FUNCTIONS	Understand and know how to form functions and relations.	
		Define relation, function, domain, range and inverse.
		Use standard notation associated with functions.
		Solve for f(g(x)) for any value of x which yield a g(x) in the domain of f (given two functions of f and g).
	Know how to form inverse functions.	
		Recognize if the inverse of a function is a function.
		Given the graph of a function, state whether its inverse is also a function.
QUADRATIC EQUATIONS	Know the general form of a quadratic equation in one or two variables.	
		Generate the general form of a quadratic equation in one or two variables.
		Identify the discriminant for a quadratic formula.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
QUADRATIC EQUATIONS (Cont.)		Use the discriminant to describe the roots of a quadratic equation.
		Explain that the product of two or more expressions is zero if and only if one of the expressions is zero.
		Verify the roots of an equation (e.g., by the "sums and products" method for equations of the degree less than or equal to 2).
		Graph quadratic relations or functions (equalities or inequalities).
		Determine the solution for an equation with one variable, one term of which contains a radical with the unknown in the radicand.
	Understand the basic ideas associated with conic sections.	
		Define conic sections.
		Define terms related to conics (e.g., cone, intersection, circle, hyperbola, major axis, eccentricity, vertices, asymptotes).

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
QUADRATIC EQUATIONS (Cont.)	Know how to graph standard quadratic equations.	Identify the graph for an equation $y = x^2 + c$ as a parabola. Describe and compute the vertex, orientation and steepness of a parabola given an equation of the form $ax^2 + bx + c = 4$. Describe the method for sketching the graph of a parabola. Recognize the graph of an equation $ay^2 + ay^2 = b$, where a and b = 0, as a circle. Identify the center and the radius, given an equation of a circle of the form $ax^2 + bx + ay^2 + dy + e = 0$. Sketch the graph of a circle. Sketch the graph of an ellipse. Recognize the equation of an ellipse. Write the equation of a specific ellipse, given its location, orientation, shape and size.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
QUADRATIC EQUATIONS (Cont.)		Sketch the graph of a hyperbola.
		Graph the hyperbola, given the equation.
		Write the equation for the hyperbola, given its graph.
		Find the asymptotes of a hyperbola.
	Know how to solve systems of equations involving conic sections.	
		Use the definition of conic section to derive equations for respective sections.
		Recognize and name the type of conic section represented, given an equation of the form $ax^2 + by^2 + cy + dy + e = 0$.
		Find the solution graphically and algebraically for a system of two equations.

SECONDARY MATH GUIDES
ALGEBRA II

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
LOGARITHMS AND EXPONENTS	Understand logarithmic functions and apply this knowledge to the solution of problems.	
		Define the terms used in working with logarithms (e.g., characteristic, interpolation, base, exponent).
		Define common and natural logarithms.
		Translate the exponential statement of equality into logarithmic form.
	Know how to estimate the answers to arithmetic problems of multiplication, division root extraction, and raising to powers using logarithms.	
		List the laws of logarithmic functions.
		Use logarithms to perform the operations of multiplication and division.
		Use linear interpolation for approximation from a table of mantissas.
		Raise a number to a stated power by using the properties of logarithms.
		Describe scientific notation in general terms and give a specific example.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
LOGARITHMS AND EXPONENTS (Cont.)		Describe logarithmic function as the inverse of an exponential function. Find the antilogarithm of a number.
	Understand exponential notation.	Define bn when n is (1) a rational number; (2) zero; (3) a negative integer; (4) a rational number in fraction form. Explain that finding the root of a positive integer is the inverse operation of raising it a power. Use the definition of laws of exponents to simplify computation.
COMPLEX NUMBERS	Understand complex numbers.	Define i as $\sqrt{-1}$. Express a complex number in the standard form a + bi. Show a graphic representation in a rectangular and/or polar coordinate system. Describe the subset relationship of real and complex numbers.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
COMPLEX NUMBERS (Cont.)	Know how to compute using complex numbers.	
		Define the basic operations for complex numbers (division, multiplication, addition, subtraction).
		Determine the sum of two or more complex numbers and simplify to a + bi form (a, b, real numbers).
		Find the absolute value of a complex number.
		Find the conjugate of a complex number.
	Know how to compute polynomial equations over the set of complex numbers.	
		Analyze an equation to determine if it has complex roots.
		Graph an equation to determine if it has complex roots.
		Verify the roots of an equation.
TRIGONOMETRY	Know the definition of the trigonometric functions of an angle in terms of a right triangle or a point in the coordinate plane.	
		Define the terms associated with angles (e.g., standard position, initial side, terminal side, sign, magnitude quadrant).

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
TRIGONOMETRY (Cont.)		Explain the idea that all trigonometric functions of an angle are determined by a point on the terminal side of the angle in standard position.
		Define the sine and cosine functions by using the wrapping function and the unit circle (e.g., the domain becomes the set of real numbers).
		Describe the domain and range for each circular function (i.e., sine, cosine, tangent, cotangent, secant cosecant).
	Know that the trigonometric function and the circular function of real numbers are related through the radian measure of angles.	
		State that the value of a trigonometric function of an angle whose measure is 0 radians is equal to the value corresponding to the circular function of the real number 0.
		Explain that a central angle of a circle and the arc length intercepted by the angle are related.
	Know how to graph circular (trigonometric) functions.	
		Determine the domain and range of a trigonometric function.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
TRIGONOMETRY (Cont.)		Sketch the characteristics of circular (trigonometric) functions (e.g., period, amplitude, phase, shift or angle).
	Know the fundamental identities of the (trigonometric) functions.	
		State the fundamental identities of circular functions.
		Prove identities using the fundamental circular (trigonometric) identities.
	Know how to solve problems related to oblique and right triangles.	
		State the conditions which determine the number of solutions for a triangle problem.
		Solve problems involving right triangles using trigonometric functions.
		Solve problems involving oblique triangles using the trigonometric functions (e.g., law of sines and cosines).
		Solve circular (trigonometric) equations.
		Use computational and measuring devices to aid in the solution of trigonometry problems.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
PROGRESSION	Understand arithmetic and geometric progressions.	
		Define sequence and series and demonstrate proper use of notation.
		Determine the sum of an infinite geometric series.
		Find the nth term of an arithmetic or geometric sequence.
	Understand the Binominal Theorem.	
		Recognize the patterns exhibited by coefficients and exponents when binomials are expanded.
		State the relationship between the coefficients in the binomial expansion and Pascal's triangle.
		Expand binomials using Pascal's triangle and the Binomial Theorem.
		Find the nth term of a binomial expansion.
		Solve a simple probability problem using the Binomial Theorem.

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
CALCULATORS AND COMPUTERS	Know how to use a computer to solve problems. (See also Computer Education Curriculum Guide.)	
		Use the vocabulary, definitions and operational procedures associated with computers and their peripherals as appropriate to needs and interests.
	Know how to use calculating devices to solve problems.	
		Use tables and calculators as tools in solving problems.

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
MATHEMATICAL SYSTEM	Understand mathematical systems and their use.	
		Define "model" as an abstract system for understanding practical and/or hypothetical situations.
		Describe geometry as a structured model of physical space dealing with sizes and shapes.
		State how theorems are used in the geometrical system.
REASONING	Understand the difference between inductive and deductive reasoning.	
		Define reasoning and give an example of its use in our lives.
		Determine whether the inductive or deductive process was used in a given example.
		Describe an everyday life situation in which inductive reasoning would be most appropriate.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
REASONING (Cont.)	Understand the characteristics of conditional, converse, inverse and contrapositive statements.	
		Give an example of a conditional statement.
		Label the hypotheses and the conclusion of a conditional statement.
		Write the converse of a conditional statement.
		Write the inverse of a conditional statement.
		Write the contrapositive of a conditional statement.
POINTS, LINES AND PLANES	Know the undefined terms of the geometric system.	
		State the difference between defined and undefined terms.
	Understand the relationships among points, lines and planes.	
		Demonstrate by construction the relationships among points, lines and planes.
		Identify the points, lines and planes of a set of geometric figures.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
POINTS, LINES AND PLANES (Cont.)		Define ray, end point, half line and half plane.
		Explain that two points determine a line and three non-collinear points determine a plane.
		Explain that two intersecting lines or two parallel lines determine a plane.
		Sketch an example of intersecting lines.
		Graph two lines from their equations to show whether they are parallel or intersecting.
	Understand and know how to measure rays and segments.	
		Label correctly: a) opposite rays; b) parallel rays and/or segments; c) intersecting rays and/or segments; d) the union of rays and/or segments; and e) midpoint of a segment.
		Calculate the length of a line segment, given the coordinates of the endpoints.
	Understand the concept of betweenness.	
		Determine the lengths of the coordinates of three distinct linear points and tell which is between the other two.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
POINTS, LINES AND PLANES (Cont.)		Verify that B is between A and C by using the definition of betweenness AB + BC = AC, given the points A, B, and C.
GEOMETRIC FIGURES	Know how to recognize geometric figures.	Identify closed geometric figures in a plane (e.g., triangle, polygon, polyhedron, sphere, octagon, hexagon).
		Describe naturally occurring examples of the closed geometric figures mentioned in the preceding (e.g., spider's web, crystalline structures).
ANGLES	Understand the postulates and theorems of angles.	Demonstrate that every angle has exactly one bisector.
		Sketch acute, obtuse, right and dihedral angles.
	Know how to identify, measure and label angles.	Identify the vertex and the rays of an angle.
		Demonstrate the three methods of naming and labeling an angle.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
ANGLES (Cont.)		Define the following relationships between angles: supplementary, complementary, linear pair, vertical, interior, exterior. Use a protractor to measure an angle. Determine the measure of any angle, given a diagram of two parallel lines intersected by a transversal and the measure of one angle. Measure angles to solve a practical problem (e.g., carpentry).
TRIANGLES	Know how to identify and classify triangles.	Classify a triangle as scalene, isosceles, or equilateral. Identify the following from a given vertex: a) angle bisector; b) median; c) altitude.
	Understand congruency theorems.	Define congruent. Describe corresponding parts of congruent geometric figures as congruent. Prove two triangles are congruent by one of the following methods: a) side, angle, side (SAS); b) side, side, side (SSS); c) angle, side, angle (ASA); or d) angle, angle, side (AAS).

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
TRIANGLES (Cont.)		Prove two right triangles are congruent by one of the following methods: a) hypotenuse, leg (HL); b) hypotenuse, angle (HA); c) leg, angle (LA); or d) leg, leg (LL).
	Understand the triangle inequality theorems and the relationships between sides and angles.	
		Apply theorems concerning inequalities in two triangles, using the "Hinge Theorem" and its converse.
	Know how to perform measurements related to triangles.	
		Use the fact that the sum of the interior angles of a triangle is 180 degrees to solve problems.
		Demonstrate that the side opposite the larger angle is the longest side.
		Determine the measure of the third angle of a triangle, given the measures of the other two angles.
		Calculate the area of a triangle.
		Use the Pythagorean Theorem to solve problems involving right triangles.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
TRIANGLES (Cont.)	Understand the conditions that must be established to demonstrate similarity between geometric figures.	
		Demonstrate that corresponding sides of similar geometric figures are proportional to each other.
		Define means, extremes, mean proportional, terms of proportion, and constant of proportionality.
POLYGONS	Know how to identify, classify and measure quadrilaterals.	
		Classify quadrilaterals as trapezoid, parallelogram, rhombus, rectangle or square.
		Calculate the area of a quadrilateral.
	Understand the theorem and definitions regarding circles.	
		Define the terms related to circles.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
POLYGONS (Cont.)		Construct drawings to illustrate secants, tangents, chords, diameters, and radii. Find the measurement of angles and segments formed by chords, secants and tangents of circles. Use the area and circumference formulas of circles to find the area, radius, circumference or diameter of a circle. Determine the measure of angles or related arcs of a circle. Make drawings to illustrate central angles and inscribed angles. Classify circles as a) concentric; b) internally tangent; c) externally tangent; d) nonintersecting; or e) intersecting at two points.
GEOMETRIC CONSTRUCTION	Know how to construct basic geometric figures.	Explain that a geometric construction is made by using only a compass and a straightedge.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
GEOMETRIC CONSTRUCTION (Cont.)		Construct an angle which is complementary, supplementary to a given angle. Construct a bisector for a given segment or angle. Construct a congruent copy of a given angle. Construct the perpendicular segment of an angle. Divide a segment into a specified number of congruent segments.
GEOMETRIC PROOFS	Know how to develop a geometrical argument in the indirect or direct method of proof.	Define a geometrical argument and its use. Make an appropriate sketch for a given theorem or problem. Write a two column proof and a paragraph proof. State the essential conditions for making an indirect proof. Determine what can be proved from a set of given conditions or what conditions are necessary to establish a conclusion.

SECONDARY MATH GUIDES
GEOMETRY

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
CALCULATORS AND COMPUTERS	Know how to use a computer to solve problems. (See also Secondary Computer Education Curriculum Guide.)	
		Use the vocabulary, definitions and operational procedures associated with computers and their peripherals as appropriate to needs and interests.
	Know how to use calculating devices to solve problems.	
		Use tables and calculators as tools in solving problems.

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
COMPLEX NUMBERS	Understand complex numbers.	
		Define the symbol "i" used for imaginary numbers.
		Define a complex number; define the set of complex numbers.
		Identify various forms of complex numbers; find equivalent forms of complex numbers.
		Graph complex numbers in either the rectangular or the polar coordinate system.
OPERATIONS WITH COMPLEX NUMBERS	Know how to perform operations with complex numbers.	
		Define basic operations with complex numbers.
		Determine absolute value of complex numbers.
		Simplify powers of "i".
		Determine conjugates of complex numbers.
		Simplify expressions with negative radicands.
		Convert rational complex expressions to standard form.
		Solve problems involving complex numbers.

SECONDARY MATH GUIDES
TRIGONOMETRY

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
VECTORS	Understand concepts related to vectors.	
		Use vector terminology.
		Solve problems using vectors.
TRIANGLE RELATIONSHIPS	Understand properties and relationships that exist between triangles.	
		Use congruency theorems to solve problems.
		Apply the Pythagorean Theorem to solve problems.
POLAR COORDINATES	Understand that polar coordinates represent points on a plane.	
		Use the relationship between Cartesian and polar coordinate systems to solve problems.
		Convert points/equations from Cartesian to polar coordinates and conversely.
		Graph equations using the polar coordinate system.
		Write equations in polar form.
RELATIONS AND FUNCTIONS	Understand concepts related to relations and functions.	
		Determine domain (range) of a linear equation given its range (domain).

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
RELATIONS AND FUNCTIONS (Cont.)		Define relations and function.
		Use function notation, concepts of mappings and concepts of even and odd functions to solve problems.
		Classify functions.
FUNCTION OPERATIONS AND GRAPHING	Know how to perform operations with functions, and graph relations and functions.	
		Use standard notation for functions.
		Graph relations in the solution of problems.
		Classify functions as discrete, continuous, 1-1, onto, etc.
		Perform basic arithmetic operations on functions and determine the domain and range of resulting functions.
		Determine the composition of two given functions.
	Know how to generate the inverse of a function or relation.	
		Define the inverse of a function.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
FUNCTION OPERATIONS AND GRAPHING (Cont.)		Graph the inverse of a given function. Determine composition of a function and its inverse.
TRIGONOMETRIC (CIRCULAR) FUNCTIONS	Understand terminology and properties related to trigonometric (circular) functions.	Define trigonometric functions with respect to a right triangle. Define trigonometric (circular) functions with respect to a point in the coordinate plane. Use the terminology for trigonometric (circular) functions. Use the wrapping function. Explain that trigonometric functions are periodic and apply this knowledge to the solution of problems. Explain that circular functions are cyclical and apply this knowledge to the solution of problems.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
TRIGONOMETRIC (CIRCULAR) FUNCTIONS (Cont.)		Find the inverses of the trigonometric functions. Use the sign (+, -) relationships of trigonometric functions in each quadrant. Use the graphing characteristics of the trigonometric functions. Use graphs of trigonometric functions to solve problems. Sketch a graph of compound trigonometric functions. Graph inverse trigonometric functions. Use graphic addition involving sine and cosine functions.
	Know how to solve trigonometric (circular) equations.	Simplify trigonometric expressions. Determine domain and range of trigonometric functions and their inverses. Give values of trigonometric functions for special real numbers. Solve right triangle problems using trigonometric functions.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
TRIGONOMETRIC (CIRCULAR) FUNCTIONS (Cont.)		Use the following: trigonometric identities; trigonometric reduction formulas; trigonometric double angle and half angle formulas; and the circular (trigonometric) sum and difference of two angles formulas. Use trigonometric tables to approximate desired values. Interpolate when using trigonometric tables. Solve application problems. Solve oblique triangle problems.
CALCULATORS AND COMPUTERS	Know how to use common calculating devices to solve problems related to trigonometry. (See also Secondary Computer Education Curriculum Guide.)	Use math tables and built-in calculator functions to solve trigonometric problems.
	Know how to use a computer to solve problems.	Use the vocabulary, definitions and operational procedures associated with computers and their peripherals as appropriate to needs and interests.

137

138

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
NUMBER THEORY	Understand number theory concepts.	Use exponential notation; perform operations with integer and/or fractional exponents.
LINEAR EQUATIONS	Understand the relationship that exists between linear equations and representations in a rectangular coordinate system.	Use the standard form equation of a line in a plane and in space. Determine slope of a line. Determine the equation of a given line. Express linear equations in slope-intercept form. Determine if lines are parallel, perpendicular, coincident or intersecting when given a system of linear equations. Determine the equation for a line given two of its points or given slope and one point or intercept. Determine the slope for a line that is parallel or perpendicular to another line.

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
MATHEMATICAL INDUCTION	Understand mathematical induction.	
		Prove statements using mathematical induction.
NUMBER SENTENCES	Understand that a number sentence may represent an analysis of a problem situation.	
		Solve compound open sentences containing the connectives "and" and "or".
		Use pictorial or graphic representatives as aids in solving word problems.
		Solve word problems involving more than one step or operation.
		Identify different ways to organize and solve problems.
		Use appropriate formulas to solve problems.
		Determine if a solution fits a given problem.
PROPERTIES AND THEOREMS OF EQUATIONS	Understand properties and theorems of equations and their roots.	
		Classify equations.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
PROPERTIES AND THEOREMS OF EQUATIONS (Cont.)		Use the general form of quadratic equations. Determine the nature of roots of a quadratic equation. Generate a polynomial equation from its roots. Use the Fundamental Theorem of Algebra, Remainder Theorem and Rational Root Theorem. Use the Binomial Theorem.
SOLVING EQUATIONS	Know how to solve equations (quadratic, polynomial, exponential, logarithmic, etc.).	Solve quadratic equations. Solve equations involving rational expressions. Solve polynomial equations. Verify the roots of an equation. Solve exponential and logarithmic equations. Use logarithms to solve power equations.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
NONLINEAR EQUATIONS	Know how to graph equations.	
		Solve and graph quadratic equations.
		Solve and graph equations involving absolute values.
		Determine whether or not an equation has complex roots.
RELATIONS AND FUNCTIONS	Understand concepts that pertain to relations and functions.	
		Define relation and function.
		Use function notation.
		Use concepts of mappings.
		Determine domain (range) of a linear equation given its range (domain).
		Use concepts of even and odd functions to solve problems.
		Classify functions as continuous, discrete, one-to-one, onto, etc.
FUNCTION OPERATIONS AND GRAPHING	Know how to perform operations with functions and graph relations and functions.	

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
FUNCTION OPERATIONS AND GRAPHING (Cont.)		Graph relations and functions. Perform basic arithmetic operations on functions and determine domain and range of resulting functions. Determine the composition of functions.
INVERSE OF A FUNCTION	Know how to generate the inverse of a function or relation.	Define the inverse of a function. Graph the inverse of a given function. Determine composition of a function and its inverse. Explain that the property of a function and its inverse are symmetric about the line y=x.
ALGEBRAIC FUNCTIONS	Know how to graph and find zeros of algebraic functions.	Define polynomial functions. Define power function. Use graphing to find the zeros of quadratic, polynomial and rational functions.

147

148

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
EXPONENTIAL FUNCTIONS	Understand exponential functions.	
		Use the laws and properties of exponents.
		Define, evaluate and graph exponential functions.
SEQUENCES	Understand the definitions of, and the notations for, sequences.	
		Define and use the notation for arithmetic sequence, infinite sequence and geometric sequence.
	Know how to find missing terms in arithmetic and geometric sequence.	
		Find the general (nth) term of arithmetic and geometric sequences.
		Use formulas for generating missing terms of a sequence.
		Determine the bounds of sequences.
SERIES	Understand series.	
		Define series.
		Find the general (nth) term of a series.
		Find the sum of n-terms of a series.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
SERIES (Cont.)		Use summation notation. Use formulas for infinite series.
LIMITS OF SEQUENCES AND SERIES	Understand theorems of limits and know how to determine limits of sequence and series.	Determine the limits of the following: (1) a series; (2) a function; (3) a convergent sequence; (4) a repeating decimal. Apply the theorems of limits.
CALCULATORS AND COMPUTERS	Know how to use common calculating devices as tools for solving problems. (See also Secondary Computer Education Curriculum Guide.)	Use math tables and built-in calculator functions to solve precalculus problems.
	Know how to use a computer to solve problems.	Use the vocabulary, definitions and operational procedures associated with computers and their peripherals as appropriate to needs and interests.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
GRAPHS OF LINEAR EQUATIONS	Understand the relationship that exists between linear equations and representations in a rectangular coordinate system.	
		Use the standard form for equation of a line in a plane and in space.
		Determine the slope of a line.
		Determine the equation of a given line.
		Express linear equations in slope-intercept form.
		Determine if lines are parallel, perpendicular, coincident or intersecting when given a system of linear equations.
		Determine the angle between two intersecting lines or planes.
SOLVING PROBLEMS	Know how to solve word problems.	
		Use pictorial or graphic representations as aids in solving problems.
		Distinguish relevant information when solving word problems.
		Solve word problems involving more than one step or operation.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
SOLVING PROBLEMS (Cont.)		Identify different ways to organize and solve problems. Use appropriate formulas to solve problems. Determine if a solution fits a given problem.
SOLVING EQUATIONS	Know how to solve equations (quadratic, polynomial, exponential, logarithmic, etc.).	Solve quadratic and polynomial equations. Solve equations involving rational expressions. Solve exponential and logarithmic equations. Use logarithms to solve power equations.
SOLVING AND GRAPHING INEQUALITIES	Know how to solve and graph inequalities.	Use properties of inequalities. Solve and graph linear and quadratic inequalities. Solve and graph inequalities involving absolute value.

SECONDARY MATH GUIDES
CALCULUS

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
RELATIONS AND FUNCTIONS	Understand concepts related to relations and functions.	
		Determine domain (range) of a linear equation given its range (domain).
		Define relation and function.
		Use function terminology.
		Use concepts of mappings.
		Use concepts of even and odd functions to solve problems.
		Classify functions as discrete, continuous, even, odd, etc.
FUNCTION OPERATIONS AND GRAPHS	Know how to perform operations with functions and graph relations and functions.	
		Use standard notation for functions.
		Graph relations and functions.
		Perform basic arithmetic operations on functions and determine domain and range of resulting functions.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
FUNCTION OPERATIONS AND GRAPHS (Cont.)		Add and subtract functions graphically. Determine the composition of functions.
INVERSE OF A FUNCTION	Know how to generate the inverse of a function or relation.	Define and graph the inverse of a function. Determine the composition of a function and its inverse. Demonstrate that a function and its inverse are symmetric about the line y=x.
EXPONENTIAL FUNCTIONS	Understand exponential functions.	Use the laws and properties of exponents. Define, evaluate and graph exponential functions.

TOPIC/CONCEPT	LEARNING OUTCOME	SAMPLE LEARNING OBJECTIVES
	The Learner will:	The Learner will:
LOGARITHMIC FUNCTIONS	Understand logarithmic functions.	Describe a logarithmic function as the inverse of an exponential function and use this to solve problems. Determine domain and range of logarithmic functions. Graph logarithmic functions. Convert exponential functions to logarithmic functions. Describe and use the properties of logarithmic functions.
TRIGONOMETRIC (CIRCULAR) FUNCTIONS	Understand terminology and properties related to trigonometric (circular) functions.	Define trigonometric functions with respect to a right triangle. Define trigonometric (circular) functions with respect to a point in the coordinate plane. Describe and use the terminology for trigonometric (circular) functions.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
TRIGONOMETIRC (CIRCULAR) FUNCTIONS (Cont.)		Apply the periodics of trigonometric functions in the solution of problems.
		Explain that circular functions are cyclical and apply this knowledge to the solution of problems.
		Find the inverses of the trigonometric functions.
	Know how to solve trigonometric (circular) equations.	
		Simplify trigonometric expressions.
		Determine domain and range of trigonometric functions.
		Give the values of trigonometric functions for the special cases.
		Solve right triangle problems using trigonometric functions.
	Understand the capabilities of trigonometric (circular) functions.	
		Use the basic circular (trigonometric) identities to solve problems.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
TRIGONOMETIRC (CIRCULAR) FUNCTIONS (Cont.)		Use the circular (trigonometric) reduction formulas to solve problems. Use the circular (trigonometric) double angle and half angle formulas to solve problems. Use the circular (trigonometric) formulas for sum and differences of two angles to solve problems.
LIMITS	Understand concepts and theorems related to limits.	Determine the limit of a function. Describe the theorem of limits, concept of nonexistent lines and two-sided limits. Define continuity and apply continuity theorems.
DIFFERENTIAL CALCULUS	Understand the concepts of differentiation and derivatives of functions.	Use the definitions of the derivative. Use notation for differentiation.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
DIFFERENTIAL CALCULUS (Cont.)		Find derivatives of algebraic, trigonometric, exponential, and logarithmic functions. Use the definition of neighborhood. Find derivatives of functions that involve sums, products, and quotients. Find the derivative of a composite function (chain rule). Find the derivative of an implicitly defined function. Find the derivative of the inverse of a function (including Arcsin x and Actan x). Perform logarithmic differentiation. Find derivatives of higher order. Contrast differentiability and continuity. Use l'Hopital's rule (quotient indeterminate forms).
	Know how to solve problems related to derivatives of functions.	

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
DIFFERENTIAL CALCULUS (Cont.)		Find slope of a curve. Find tangent and normal lines to a curve (including linear approximations); determine point at which line is tangent to a curve. Sketch curves including: increasing and decreasing functions; relative and absolute maximum and minimum points; concavity; points of inflection. Solve extreme value problems. Find velocity and acceleration of a particle moving along a line. Find related rates of change. Find average and instantaneous rates of change.
INTEGRAL CALCULUS	Understand the concepts of integration and integrals of functions.	Use the definition of "integration" as it relates to the calculus. Use notation for integration.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
INTEGRAL CALCULUS CONCEPTS (Cont.)		Describe differentiation and integration as inverse operations. Find integrals of algebraic, trigonometric, exponential and logarithmic functions. Integrate by substitution (use of identities, change of variable). Perform simple integration by parts. Use the concept of the definite integral as an area. Approximate the definite integral by using rectangles. Use the definition of the definite integral as the limit of a sum. Use the properties of the definite integral.
	Know how to solve problems related to integrals of functions.	Find distance and velocity from acceleration with initial conditions. Find solutions of $y^1 = ky$ and applications to growth and decay.

TOPIC/CONCEPT	LEARNING OUTCOME The Learner will:	SAMPLE LEARNING OBJECTIVES The Learner will:
INTEGRAL CALCULUS (Cont.)		Find average (mean) value of a function on an interval.
		Find the area between curves.
		Find the volume of a solid of revolution (disc, washer, and shell methods) about the X- and Y-axes or lines parallel to the axes.
CALCULATORS AND COMPUTERS	Know how to use common calculating devices to solve problems related to calculus. (See also Secondary Computer Education Curriculum Guide.)	
		Use math tables and built-in calculator functions to solve calculus problems.
	Know how to use a computer to solve problems.	
		Use the vocabulary, definitions and operational procedures associated with computers and their peripherals as appropriate to needs and interests.

APPENDIX A

At the secondary level, several courses with related topic/concept areas are offered, including general math, consumer math, pre-algebra, etc.

General Math

Whole Numbers
Number Theory
Fractions
Decimal Fractions
Ratio, Proportion and Percent
Measurement
Integers
Graphing
Probability
Statistics
Word Problems
Career Education
Calculators and Computers

Consumer Math

Basic Math Skills
Estimation
Graphs
Decision Making Skills
Comparison Shopping
Insurance
Taxes
Employment
Banking
Credit
Budgeting
Investing
Word Problems
Probability and Statistics
Calculators and Computers

Pre-Algebra

Number Theory
Fundamental Operations
Ratio, Proportion and Percent
Exponents
Properties
Square Root
Scientific Notation
Integers
Algebraic Equations and Inequalities
Measurement
Graphing
Operations with Mathematical Expressions
Word Problems
Calculators and Computers

Algebra I

Axioms for Real Numbers
Sets, Numbers, Operations
Relationships of Number Sets
Linear Equations and Inequalities
Linear Systems
Polynomials and Factoring
Calculators and Computers

Algebra II

Rational Algebraic Expressions
Relations and Functions
Quadratic Equations
Logarithms and Exponents
Complex Numbers
Trigonometry
Progression
Calculators and Computers

Geometry

Mathematical System
Reasoning
Points, Lines and Planes
Geometric Figures
Angles
Triangles
Polygons
Geometric Construction
Geometric Proofs
Calculators and Computers

Trignometry

Complex Numbers
Operations with Complex Numbers
Vectors
Triangle Relationships
Polar Coordinates
Relations and Functions
Function Operations and Graphing
Trigonometric (Circular) Functions
Calulators and Computers

Pre-Calculus	Calculus
Number Theory	Graphs of Linear Equations
Linear Equations	Solving Problems
Mathematical Induction	Solving Equations
Number Sentences	Solving and Graphing Inequalities
Properties and Theorems of Equations	Relations and Functions
Solving Equations	Function Operations and Graphs
Nonlinear Equations	Inverse of a Function
Relations and Functions	Exponential Functions
Function Operations and Graphing	Logarithmic Functions
Inverse of a Function	Trigonometric (Circular) Functions
Algebraic Functions	Limits
Exponential Functions	Differential Calculus
Sequences	Integral Calculus
Series	Calculators and Computers
Limits of Sequences and Series	
Calculators and Computers	

Local districts must choose the specific order in which they will offer these courses.

RESPONDENTS	PROBLEMS, ISSUES, CONCERNS	DISPOSITION
Unidentified Respondent	Delete programming at grades 7 and 8.	Cross-referencing to the Secondary Computer Guide has been added.
	Algebra should encompass two, one-year courses.	The Algebra I and Algebra II courses have been designed as full-year courses.
	Correct typos.	Done.
Holly Stephens Louise Petermann Alaska Council of Teachers of Mathematics (ACTM)	Submitted guides with specific suggestions noted directly on the guides.	These suggestions have been incorporated into the material to the greatest extent possible.
Marla Trible Centralized Correspondence Study (CCS)	Need more basic skills and applications.	Agreed, and the guides have been revised accordingly.
	All objectives are not written in behavioral terms.	All objectives have been carefully checked to ensure consistency.
	Some objectives are too broad and are written more as a course outline.	These have been rewritten.
	The quality of objectives varies from course to course.	Standardization among objectives has been carefully checked.

ALASKA CURRICULUM GUIDE: Secondary Math

RESPONDENTS	PROBLEMS, ISSUES, CONCERNS	DISPOSITION
Marla Trible Centralized Correspondence Study (CCS) (cont.)	Remedial math is not evident.	It was decided by the Department in consultation with the Curriculum Cabinet that no remedial courses or programs be included in these guides since the learning outcomes sought are not different from regular courses or programs.
	The guides need more life skills objectives before and after the consumer math course.	Additional objectives in this area have been added to a limited extent.
	The guides need more hands-on activities.	Additional objectives in this area have been added.
	Sequence of algebra concepts needs revising.	Done.
	Standardize the language of the objectives.	Done.
	Specific comments were written directly on the guides.	These were carefully reviewed and incorporated into the material.

ALASKA
MODEL
CURRICULUM
GUIDE
PROJECT

Subject: MATH
Course:
Level: SECONDARY
Grade(s): 9-12
Date: 8-20-85

PERCENTAGE OF
EDUCATIONAL OUTCOMES

Objective	N	%	Histogram of Percentages (10 20 30 40 50 60 70 80 90 100)
COGNITIVE			
1.10 Knowledge of specifics	20	11	******
1.20 Knowledge of ways and means of dealing with specifics	0	0	
1.30 Knowledge of universals and abstractions	0	0	
2.00 Comprehension	109	61	**********
3.00 Application	40	22	**********
4.00 Analysis	7	4	**
5.00 Synthesis	2	1	*
6.00 Evaluation	1	1	*
SUBTOTAL	179	100	
AFFECTIVE	0	0	
PSYCHOMOTOR	0	0	
Not Classifiable	0	0	
TOTAL	179	100	